

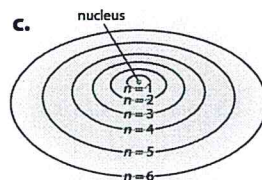
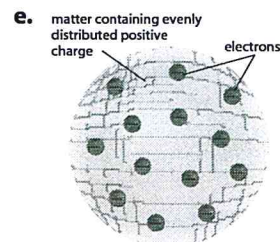
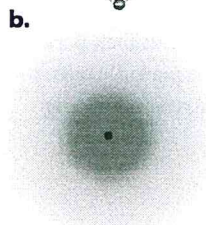
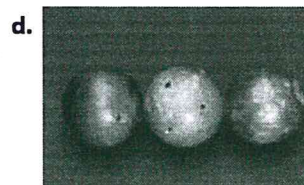
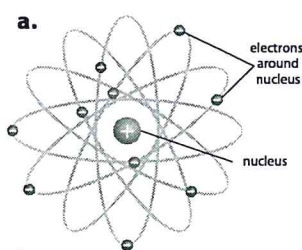
Select the letter of the best answer below.

- T/I** If the last electron to be added to an atom had the quantum numbers  $n = 5$  and  $l = 2$ , which element could it be?
  - technetium
  - rhenium
  - bismuth
  - barium
  - silver
- K/U** Which of the electron configurations could not represent an atom of a real element?
  - $[\text{He}]2s^22p^3$
  - $[\text{Xe}]6s^25d^{10}$
  - $[\text{Ar}]4s^23d^{10}4p^5$
  - $[\text{Kr}]3s^22d^7$
  - $[\text{He}]2s^2$
- K/U** Which scientist is responsible for the rule that says one electron must be loaded into each degenerate orbital before they can be paired up?
  - Bohr
  - Schrödinger
  - Aufbau
  - Pauli
  - Hund
- K/U** Which periodic trend below represents the energy required to produce a cation from a neutral atom?
  - electron affinity
  - ionization energy
  - electronegativity
  - electropositivity
  - all of the above
- T/I** Which of the following is the condensed electron configuration for bromine?
  - $[\text{Kr}]4s^23d^{10}4p^5$
  - $[\text{Ar}]4s^14d^{10}4p^6$
  - $[\text{Ar}]4s^23d^{10}4p^5$
  - $[\text{Kr}]4s^24d^{10}4p^5$
  - $[\text{Ar}]3s^23d^{10}4p^5$
- K/U** Which statement below is false?
  - All waves travel at the speed of light,  $c = 3.0 \times 10^8 \text{ m/s}$ .
  - Frequency and wavelength are two properties of a wave found in the universal wave equation.
  - Frequency and wavelength are inversely proportional to each other.
  - Sonar is related to sound energy; therefore, sonar is not found on the electromagnetic spectrum.
  - None of the statements are false; all are true.
- T/I** Which of the following compounds would not be expected to dissolve in water?
  - $\text{NH}_3$
  - $\text{H}_2\text{S}$
  - $\text{ICl}_3$
  - $\text{SiF}_4$
  - $\text{BCl}_3$

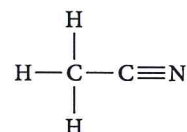
- K/U** Which of the following elements is not capable of forming molecules in which one of the atoms has an expanded octet?
  - Ga
  - Br
  - P
  - C
  - Xe
- T/I** Which ion is represented by  $[\text{Ar}]4s^23d^{10}4p^6$ ?
  - $\text{S}^{2-}$
  - $\text{Se}^{2+}$
  - $\text{Br}^-$
  - $\text{Ca}^+$
  - $\text{P}^{3-}$
- K/U** A substance that has a melting point of  $1850^\circ\text{C}$  and a boiling point of  $2700^\circ\text{C}$  is insoluble in water and is a good electrical insulator. The substance is most likely
  - an ionic solid.
  - a polar covalent solid.
  - a metal.
  - a network solid.
  - a molecular solid.

Use sentences and diagrams as appropriate to answer the questions below.

- C** For each of the models of the atom below, answer the following questions.
  - What model does it represent?
  - What features of the atom does it explain correctly?
  - Explain one way in which the model is inadequate and does not account for a certain property of atoms.



12. **K/U** Consider Rutherford's gold foil experiment.
- What was the evidence that suggested the atom contained a positive nuclear core?
  - What was the evidence that suggested the atom contained mostly empty space?
  - What was expected to happen based on Thomson's plum pudding model?
13. **A** If you were handed an atomic spectrum, how would you know if it was an emission spectrum or an absorption spectrum? List two features that you would use to correctly identify it.
14. **T/I** Use a basic periodic table that does not contain electron configurations to determine which element is defined by  $[\text{Ar}]4s^23d^7$ .
15. **K/U** What information about an atom is *not* discernible from its electron configuration?
16. **T/I** An orbital has the values  $n = 5$  and  $l = 1$ .
- Give the possible values for  $m_l$ .
  - What type of orbital is associated with these quantum numbers?
  - How many orbitals are associated with these quantum numbers?
17. **A** Lewis structures and VSEPR theory assist chemists in determining the detailed structure of molecules. However, they sometimes encounter molecules that could be one of two possibilities. For example, the molecule sulfur dioxide,  $\text{SO}_2(\text{g})$ , could be a resonance structure or an expanded octet.
- Draw Lewis structures for each of these two possibilities.
  - Describe the type of experimental evidence that chemists would use to best determine which of these two possibilities is the most likely structure.
18. **T/I** The condensed electron configuration for an indium atom is  $[\text{Kr}]5s^24d^{10}5p^1$ . Without using a periodic table, identify the group number, period number, and orbital block in the periodic table to which indium belongs. Explain your reasoning.
19. **C** Draw the Lewis structure for HCN. Include all structures if it is a resonance structure.
20. **C** Draw the Lewis structure for  $\text{CO}_3^{2-}$ . Include all structures if it is a resonance structure.
21. **K/U** Explain how the octet rule is connected to the noble gases.
22. **T/I** Write the following pairs of bonds in your notebook. Indicate the partial positive end and the partial negative end of each bond using the special symbols. In each pair, circle the bond that is more polar than the other.
- $\text{C}-\text{O}$ ,  $\text{C}-\text{S}$
  - $\text{C}-\text{F}$ ,  $\text{C}-\text{N}$
  - $\text{P}-\text{H}$ ,  $\text{P}-\text{Cl}$
23. **C** Design a type of electron dot diagram that would obey the aufbau principle. Draft a set of rules that would accompany this type of diagram.
24. **T/I** You have been given five unknown solids to identify as being one of each of the five types of solids. You have been given only a limited supply of each.
- Describe the sequence of tests you would run to make your identification as efficiently as possible.
  - Draw a flow diagram to represent the test procedure in part (a).
25. **A** The structural formula for acetonitrile,  $\text{CH}_3\text{CN}$ , is shown below:



Examine the structure of the acetonitrile molecule. Identify the hybrid orbitals present in each carbon atom, and predict the shape of the molecule around each carbon atom based on the bond angles.

### Self-Check

If you missed question ...	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Review section(s)...	3.3	3.2	3.3	3.3	3.3	3.1	4.1	4.2	3.3	4.1 4.2	3.1	3.1	3.1	3.3	3.2	3.2	4.2	3.3	4.2	4.2	4.2	4.1	3.3 4.2	4.1 4.2	4.2